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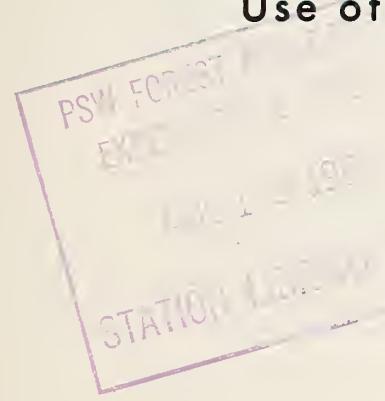
FOREST SERVICE
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ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Use of a Ponderosa Pine Forest in Arizona by Deer, Elk, and Cattle

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Ponderosa pine forests of Arizona provide important livestock range and game habitat during summer. They occupy about 8 percent of the area of the State, between elevations of 6,000 and 7,500 feet. In addition to their value for game and livestock, they are important for timber production, as watersheds, and as recreational areas.

Vegetation characteristics of ponderosa pine forests influence distribution of forage use by game and livestock. Maintenance and improvement of such ranges and habitats depends upon detailed knowledge of such use.

This study reports the use made of a ponderosa pine forest in Arizona as measured by accumulated dropping groups of deer, elk, and cattle. Use varied widely with presence or absence of woody plant overstory and kind and abundance of herbaceous vegetation. Findings suggest several possibilities for improving range conditions for cattle and habitat for deer and elk in similar forests.

Study Area

Measurements were made in a logged-over ponderosa pine forest on the Apache National Forest in east-central Arizona. The area was bounded by the Black River on the south, West Fork of Black River on the east, the Buffalo Crossing-Maverick road on the north, and Centerfire Creek on the west (fig. 1). The total study area included about 7,500 acres. The terrain was generally uniform and about level.

The overstory was pure ponderosa pine (*Pinus ponderosa* Lawson). Herbaceous vegetation was dominated by Arizona fescue (*Festuca arizonica* Vasey) and mountain muhly (*Muhlenbergia montana* (Nutt.) Hitchc.). About 13 percent of the area was in natural forest openings characterized by spike muhly (*Muhlenbergia wrightii* Vasey). Numerous forbs grew in both openings and forest, especially in lighter stands of perennial grass.

The area was logged between 1951 and 1958 by the improvement-selection method for sustained yield. About 50 percent of the original volume of the forest was removed by logging.

The area is properly grazed by cattle from about June to October. Fairly high populations

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of both deer and elk use the area during summer. The importance of ponderosa pine habitat for deer is suggested by the estimate that in 1961 about 27 percent of the deer harvested in Arizona came from this kind of habitat.²

Methods

Since natural openings in ponderosa pine forests are believed to be key livestock range and game habitat areas,³ 10 natural openings, of from 0.7 to 120 acres, were selected for

²McCulloch, Clay Y. Watershed and game management. In *The Arizona Watershed program in review*. Ariz. Watershed Symp. Proc. 6:25-27. 1962.

³Reynolds, Hudson G. Use of natural openings in a ponderosa pine forest of Arizona by deer, elk, and cattle. U. S. Forest Serv., Rocky Mountain Forest and Range Exp. Sta. Res. Note 78, 4 pp., illus. 1962.

the study. Four belt transects of equal length were started near the center of each opening, and extended an equal distance into adjacent forest.

Each belt transect was divided into contiguous sampling plots 2 by 50 feet. Deer, elk, and cattle dropping groups of unknown age were counted on each sampling plot. Over-story on the 1/10-acre around a sample plot was classified as to whether dominated by trees over 12 inches (mature), 11.5 inches or less (reproduction), or the plot was unstocked (fig. 2). Herbaceous vegetation on each sample plot was classified as perennial grasses or forbs.

Comparative Total Use of Forest and Openings

A comparison of accumulated dropping groups between forest and natural openings is

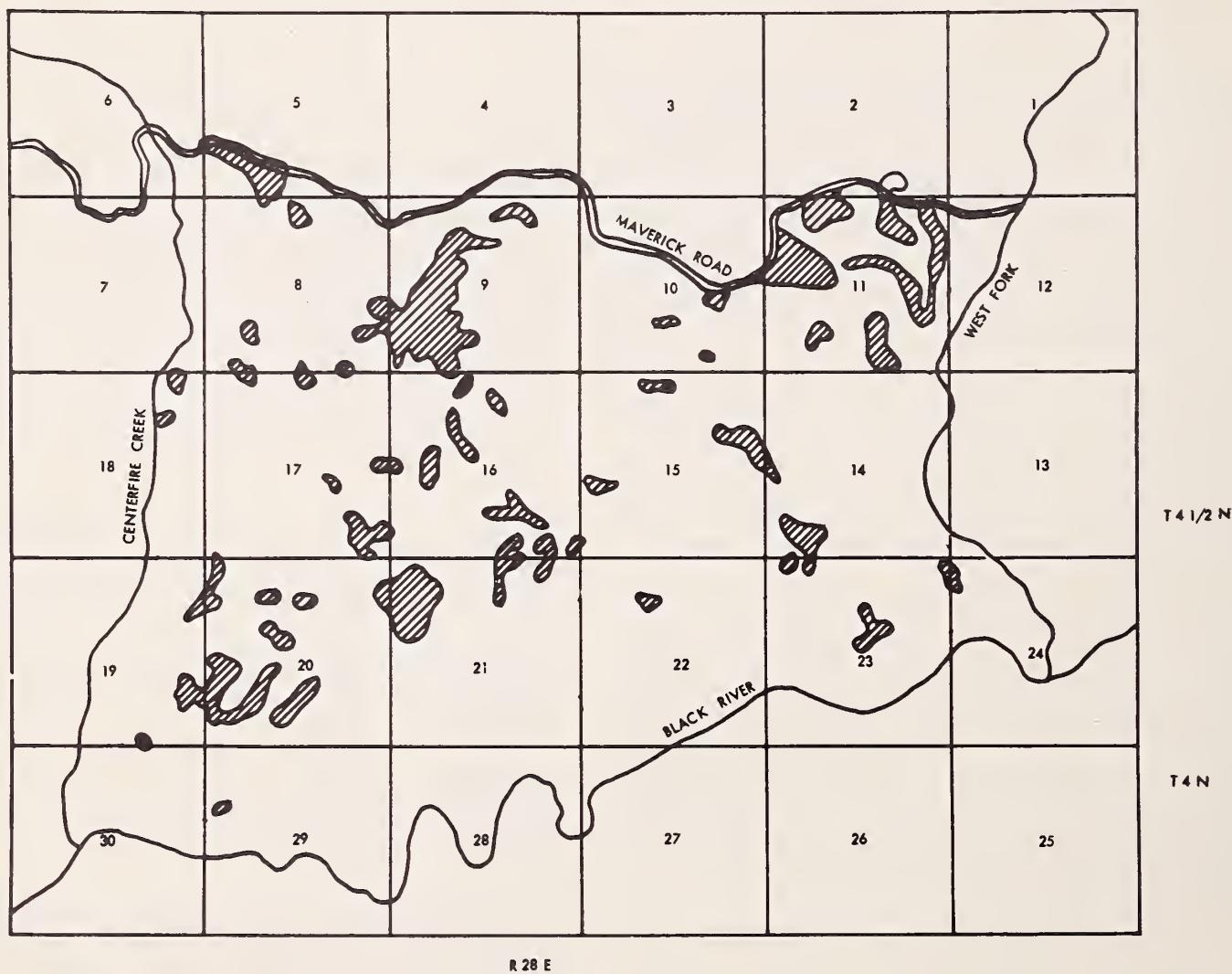


Figure 1.--Study area on the Apache National Forest about 10 miles west of Buffalo Crossing on the Black River. Shaded areas show distribution and size of natural openings in the ponderosa pine forest.



Figure 2.--Above, Ponderosa pine forest characteristics. The foreground is unstocked; mature trees in right background, reproduction in left background. Below, Natural openings were dominated by perennial grasses, mainly spike muhly, and numerous forbs.



assumed to indicate the relative use (foraging, resting, and bedding) of the two sites for deer, elk, and cattle. For deer, the average difference in number of dropping groups between openings and adjacent forest lands was negligible (fig. 3). For elk and cattle, however, dropping groups averaged more numerous in natural openings.

Elk dropping groups were consistently more numerous in individual openings than in the forest. With the exception of one opening, cattle droppings showed the same consistency. For deer, differences in dropping group densities between opening and adjacent forest were inconsistent.

Use In Relation To Forest Border

Average dropping-group densities for all animal classes varied greatly, but inconsistently, from one opening to another. This suggests that habitat factors, such as quantity and quality of forage, distance to water, and character of cover, influence the amount of use of any given opening. Since there was no consistent relation between dropping-group densities and size of openings, all openings were averaged together to establish the relation of animal use to forest border.

Density of dropping groups varied with distance from forest borders (fig. 4). Number

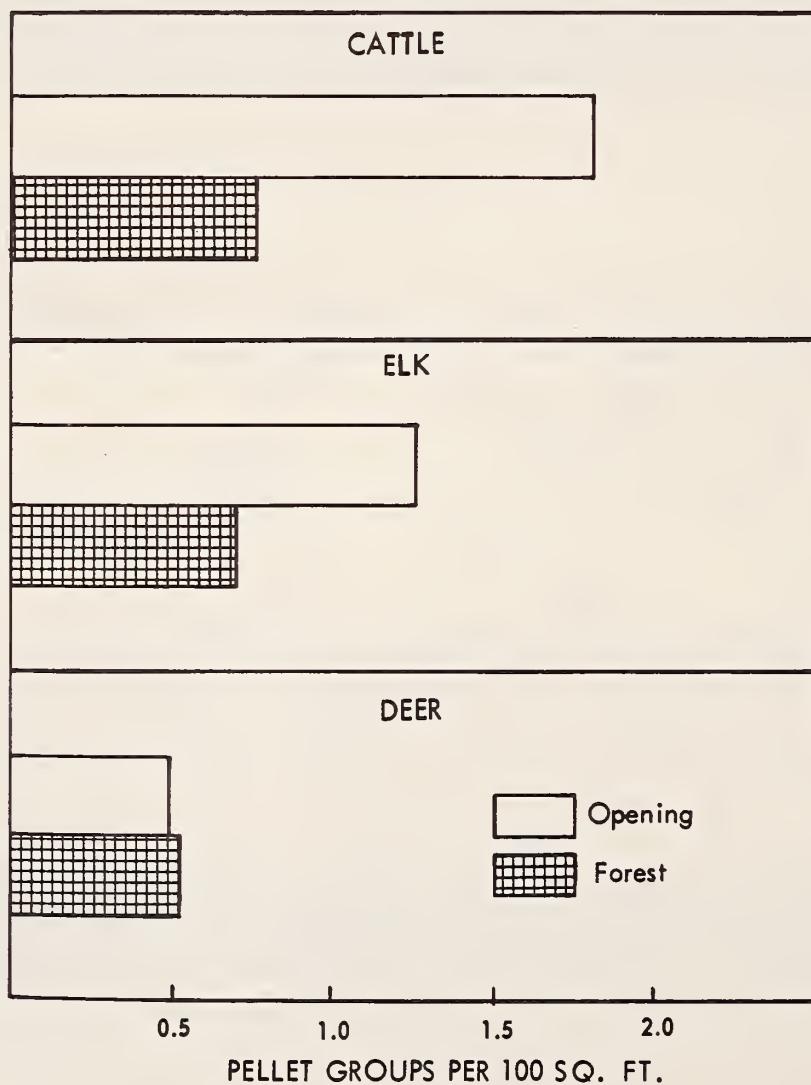


Figure 3.--Comparison of average dropping group densities for elk, deer, and cattle between all openings and adjacent forests.

of dropping groups for elk and cattle (within acceptable sampling variation) decreased with distance from border into forest, and became fairly constant at about 300 feet within the forest. Number of dropping groups of deer remained about the same with increasing distance into the forest from the border.

In openings, the relation of dropping-group densities to forest border depended on animal class. Cattle droppings were most numerous at distances of more than 1,200 feet from the forest border; densities were lowest between 600 and 1,200 feet, and intermediate at 500 feet or less from the forest border.

Elk droppings in openings were most abundant within 800 feet of the forest border, and

decreased gradually thereafter (with slight sampling variation); no groups were found beyond 1,400 feet.

Deer dropping groups were slightly higher in openings than within the forest for about 600 feet from the forest border. Thereafter, densities decreased gradually until no droppings were found beyond 1,200 feet.

Opening Size In Relation To Use

Forest border relations suggest that distance across an opening influences use by deer and elk, but not cattle. Presumably, cattle use is not affected by shape and size of forest openings, because proximity of cover

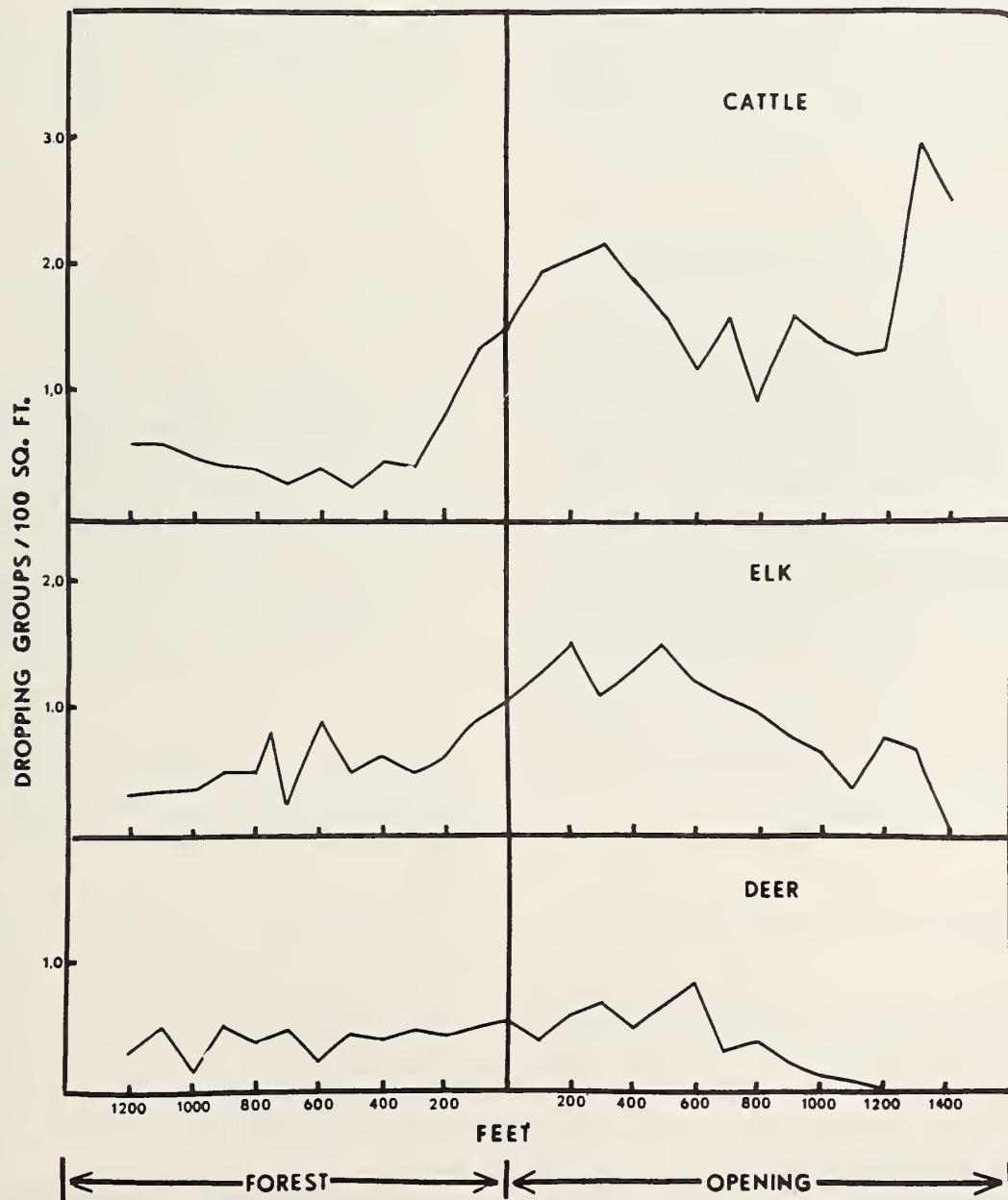


Figure 4.--Abundance of dropping groups of deer, elk, and cattle in relation to distance from forest border.

is relatively unimportant. In contrast, use of openings by deer and elk appears to depend strongly upon distance to cover.

Evidently, deer and elk do not use openings to any extent that are more than 2,200 or 2,600 feet across, respectively. For use of openings to be as high or higher than adjacent forest for both deer and elk, distance across an opening should not exceed 1,600 feet. A circular opening of this diameter would contain about 46 acres.

That border-opening relations vary with kind of habitat, species of animal, and population densities, is indicated by other findings. In the chaparral of California, black-tailed deer did not feed more than 300 feet from chaparral cover.⁴ In the pinyon-juniper of Arizona, no statistically significant differences were measured between deer pellet groups in cover and up to one-half mile into clearings.⁵

Effect Of Herbaceous Plants On Use

Density of dropping groups varied with kind and abundance of herbaceous plant cover (fig. 5). The relations between plant cover and dropping groups were fairly consistent, however, for forest and openings.

For the vegetation conditions in this forest, greatest densities of dropping groups of elk and cattle were associated with perennial grass. Moreover, numbers of dropping groups were greater where there was more perennial grass. For deer, highest dropping-group densities were associated with forbs, also in keeping with their abundance.

Management Implications

Several management possibilities, at least of direction, are implied by these findings.

⁴Taber, R. D., and Dasmann, R. F. *The black-tailed deer of the chaparral. Calif. Dep. Fish & Game Bull.* 8, 193 pp., 1958.

⁵Arizona Game and Fish Department. *Wildlife news. Ann. Rep.*, 7 pp., 1961.

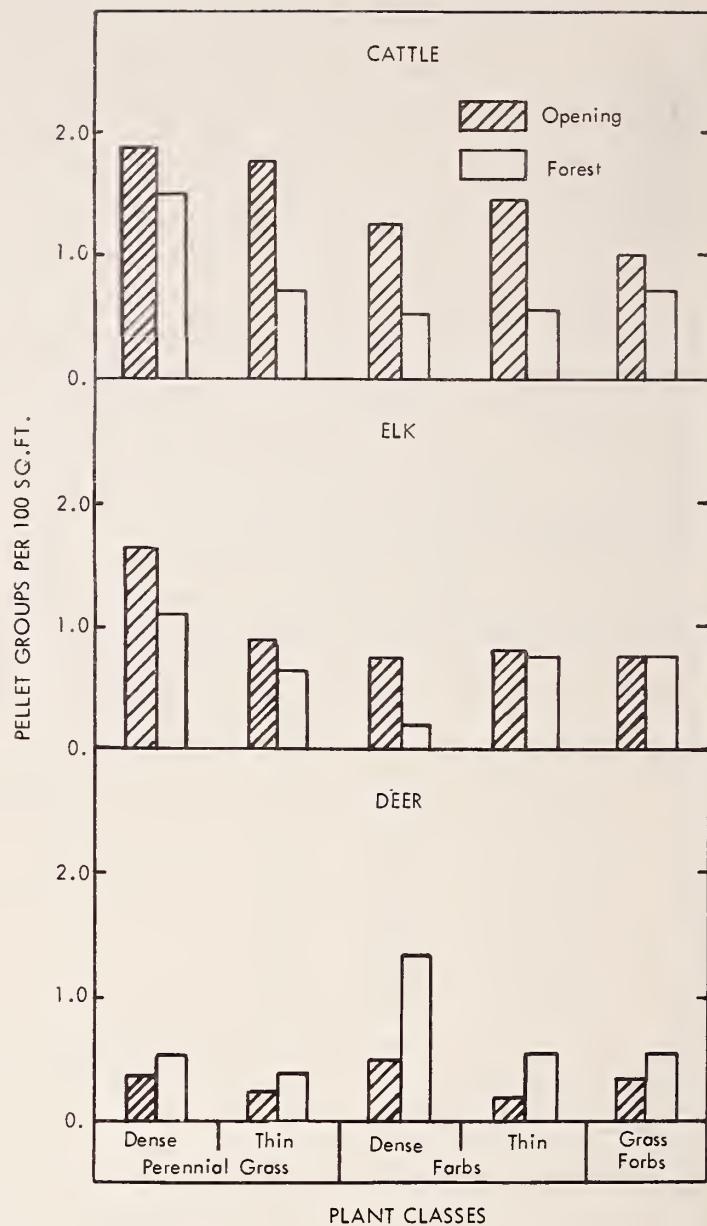


Figure 5.--Relation of densities of dropping groups of deer, elk, and cattle to kind and abundance of herbaceous plant cover.

Quantitative management recommendations for specific areas will require more detailed study and analysis.

Management suggestions are based on the following conclusions: first, in ponderosa pine forests, openings are an important segment of livestock range and habitat for elk and deer; second, distance across an opening influences use by deer and elk; third, kind and abundance of forage affect use by elk, deer, and cattle.

Management plans for benefiting livestock range and improving deer and elk habitat could consider:

1. Where trees are encroaching on natural openings, particularly on heavy clay, poorly aerated soils where the potential for forage production is higher than for tree growth, game habitat and livestock range could be improved by reduction or removal of the invading trees.
2. When trees are clear cut in strips, blocks, or natural-tree groups, openings less than 1,600 feet across (46 acres for a circular plot) would best coordinate timber management with deer and elk habitat improvement.
3. Large natural openings that are below potential for forage production could be more efficiently utilized if they were reseeded to perennial grasses preferred by elk and cattle.
4. After logging, skid trails, roads, and other disturbed areas could be seeded to forbs beneficial to deer, since deer seem to make better use of forested areas than cattle and elk.

Summary

1. Comparative use of timbered areas and natural openings within a cutover forest by elk, deer, and cattle was determined in a ponderosa pine forest of Arizona by counting accumulated dropping groups. The forest contained 13 percent natural openings, varying in size from 0.7 to 120 acres.
2. For deer, numbers of dropping groups in forest and openings averaged about the same, whereas dropping groups of elk and cattle were more numerous in openings than in forests.
3. With respect to distances into openings from forest borders -- cattle droppings were abundant beyond 1,400 feet, elk droppings were not found beyond 1,400 feet, and deer droppings were absent beyond 1,200 feet.
4. Greatest numbers of elk and cattle dropping groups were associated with perennial grasses; greatest deer dropping density was associated with forbs.
5. Cattle used all sizes of forest openings. Openings less than 1,600 feet across (46 acres for a circular opening) were used most effectively by deer and elk.
6. Several livestock range and game habitat management considerations are suggested by these findings. Among the practices that should be beneficial to deer, cattle, and elk are: (1) Reduce tree invasion into natural openings, particularly where heavy clay, poorly aerated soils exist. (2) When clear cutting in strips, blocks, or natural-tree groups, recognize that deer and elk use most effectively the zone within cleared areas up to 800 feet from the forest border. (3) When improving large natural openings, emphasize reseeding with perennial grasses acceptable to cattle and elk. (4) When seeding areas disturbed during logging, emphasize forbs palatable to deer.

